two chromosomes of one of the parental species have been added to the complete genome of the other. Speciation correlated with the addition of the equivalent of whole chromosomes is now well established for the genus *Clarkia* (Lewis 1953a, b, and 1954) and will be further investigated in *Mentzelia*.

Section Mentzelia. One species in this section, *Mentzelia arborescens* Urban & Gilg has been examined cytologically and found to have 14 pairs of chromosomes. These chromosomes are all approximately the same size and do not fall into two distinct size classes as in *M. laevicaulis*.

Department of Botany,
University of California, Los Angeles.

Literature Cited

Abrams, L. 1951. Illustrated flora of the Pacific states. 3:134–142. Stanford University.

Darlington, Josephine. 1934. A monograph of the genus Mentzelia. Ann. Mo. Bot. Gard. 21:103–226.

Lewis, H. 1953a. The mechanism of evolution in the genus Clarkia. Evolution 7:1–20.

———. 1953b. Chromosome phylogeny and habitat preference of Clarkia. Evolution 7:102–109.

———. 1954. Quantitative variation in wild genotypes of Clarkia. International Union of Biological Sciences. Series B, No. 15. Symposium on Genetics of Population Structure.

Lewis, H. and R. Snow. 1951. A cytotaxonomic approach to Eschscholtzia. Madroño 11:141–143.

Sugiura, T. 1936. Studies on the chromosome numbers in higher plants, with specific reference to cytokinesis, I. Cytologia 7:590.

## CHROMOSOME COUNTS IN THE SECTION SIMIOLUS OF THE GENUS MIMULUS (SCROPHULARIACEAE)

Robert K. Vickery, Jr.

This report[1] on the determination of chromosome numbers in the section *Simiolus* of the genus *Mimulus* is an integral part of a long range investigation into the taxonomy, genetics, and evolution of species in *Mimulus* (Vickery, 1951). The chromosome study was undertaken in order to improve our understanding of the many genetic barriers known to be present in the genus, particularly the ones in the most intensively studied section, *Simiolus* (Vickery, 1952). *Mimulus* chromosomes are small, averaging about three-fourths of a micron long by one-half micron wide and are therefore relatively difficult to study. Hence, it was necessary to develop a special technique for this investigation.

The chromosome counts were obtained by smearing anthers and observing meiosis in the pollen mother cells. The procedure consisted of

[1] The work was supported by the Research Fund of the University of Utah. The author wishes to thank Drs. Ira L. Wiggins, William M. Hiesey, and Jens Clausen for their helpful criticisms of the manuscript.

Table 1. Chromosome Counts in Mimulus, Section Simiolus

New Counts

n = 14 *M. guttatus* DC.
Pacific Grove, Monterey County, California, altitude 5 feet, *Vickery 1* (5001).

Chew's Ridge, Monterey County, California, altitude 4500 feet, *Vickery 3* (5004).

Wendover, Tooele County, Utah, altitude 4300 feet, *W. P. Cottam,* June 6, 1953 (5852).

Salt Lake City, Salt Lake County, Utah, altitude 4400 feet, *Vickery 330* (5834).

Fish Haven, Bear Lake County, Idaho, altitude 6100 feet, *Vickery 332* (5837).

n = 14 *M. tilingii* Regel
Little Cottonwood Canyon, Salt Lake County, Utah, altitude 8800 feet, *Vickery 337* (5846).

n = 14 *M. glabratus* var. *utahensis* Pennell
Mono Lake, Mono County, California, altitude 6440 feet, *Stebbins 714* (5048).

Previously Reported Counts

2n = ca. 64 *M. luteus* L. and its horticultural varieties, *M. tigrinus* and *M. tigrinoides* (Brozek, 1932).

2n = 48 *M. guttatus* DC. (Maude, 1939).

n = 14 *M. guttatus* DC., var. *typicus* Campbell, var. *gracilis* Campbell, var. *grandis* Greene (Campbell, 1950).

n = 14 *M. guttatus* DC. (G. L. Stebbins, Jr., personal communication). Mount Diablo, Contra Costa County, California, altitude 1000 feet. *Stebbins 703* (5052).

n = 14 *M. nasutus* Greene (G. L. Stebbins, Jr., personal communication). Hastings Reservation, Monterey County, California, altitude 1800 feet, *Stebbins 701* (5044).

---

fixing buds in a fluid made up of two parts absolute ethanol to one part propionic acid. Fixations were made from 2:00 to 3:00 p.m. as that was apparently the optimum time. The proper bud size for fixation varied from 1.0 to 6.5 millimeters depending upon the particular race. The buds were left in the fixative for approximately one hour and then were transferred to a propio-orcein stain for approximately 30 minutes. The stain consisted of a 2 per cent solution of natural orcein dye in 45 per cent propionic acid. After staining, the small buds were smeared directly while the large buds were dissected and only the anthers smeared. The slides were put in an ethanol vapor chamber and then transferred to an ethanol bath to complete the dehydration. They were mounted in a synthetic resin, "Permount," supplied by the Fischer Scientific Company. The con-

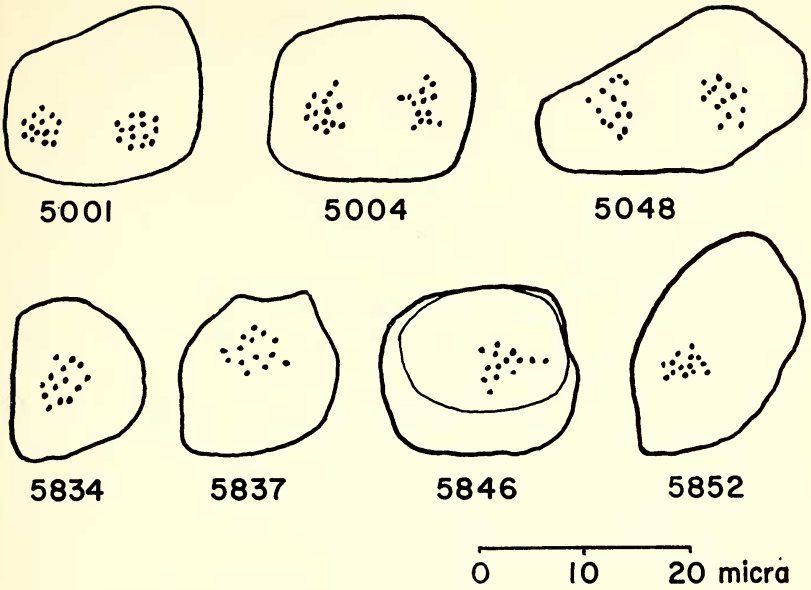


FIG. 1. Meiotic chromosomes of pollen mother cells of *Mimulus*. All are n = 14. Cultures 5001, 5004, 5834, 5837, 5852 represent different forms of *M. guttatus* while 5846 is a form of *M. tilingii* and 5048 of *M. glabratus* var. *utahensis*. The plants of 5834 and 5837 are in first metaphase while all the others are in second metaphase. For cultures in second metaphase the two figures were drawn only if the counts were clear in both. The camera lucida drawings were made at an original magnification of 1,750 diameters.

trast between the chromosomes and the cytoplasm improved for the first two days after staining and was still good after several months.

Pressed specimens of all the forms counted have been prepared for future reference and will be deposited in the Dudley Herbarium of Stanford University and the Garrett Herbarium of the University of Utah. The chromosome numbers were found to be n=14 in the three species studied. The various forms of these species come from localities ranging from sea level to 8,800 feet altitude (see Table 1). The numbers in parentheses in Table 1 are the author's culture numbers and serve as cross references for these forms in papers presenting the results of the experimental work.

Campbell (1950), Stebbins (personal communication), and the present author agree that the chromosome numbers of the North American races of *M. guttatus* are n=14 in contrast to Maude's (1939) report of 2n=48 for material presumably of European origin. It will be interesting if this high but unrelated number of chromosomes is verified. There are strong indications that some of the American races have higher polyploid numbers although no unambiguous counts are presently available.

The chromosome counts reported here indicate that some of the strong genetic barriers in the section *Simiolus* (Vickery, 1952), namely, those

between *M. guttatus, M. tilingii,* and *M. glabratus,* are probably due to gene or cryptic structural differences rather than to differences in chromosome number. However, the latter reason appears to be the cause of the complete genetic barrier between these species and *M. luteus.* Work is in progress to obtain additional chromosome counts of the races and species of *Mimulus* in order to further our understanding of the nature of the many genetic barriers of various degrees known to be present in the genus.

Division of Biology,
University of Utah,
Salt Lake City 1, Utah

### Literature Cited

Brozek, A. 1932. Mendelian analysis of the "red-orange-yellow" group of flower-colours in Mimulus cardinalis hort. Preslia 11:1–10.

Campbell, G. R. 1950. Mimulus guttatus and related species. El Aliso 2:319–335.

Maude, P. F. 1939. A list of the chromosome numerals of species of British flowering plants. New Phytologist 38:1–31.

Vickery, R. K., Jr. 1951. Genetic differences between races and species of Mimulus. Carnegie Institution of Washington Year Book 50:118–119.

———. 1952. A study of the genetic relationships in a sample of the Mimulus guttatus complex. Dissertation. Stanford University, California. 253 pp. typescript.

## NOTES ON NEVADA MIMULUS

Gabriel Edwin

In the course of preparing the Scrophulariaceae for "Contributions Toward a Flora of Nevada," a few situations in *Mimulus* have come to my attention that require clarification.

### Mimulus bigelovii Gray

Mimulus bigelovii Gray var. ovatus Gray, Syn. Flora No. Am. ed. 2, Vol. 2, Pt. 1: Suppl. 445. 1886. *Eunanus cusickii* Greene, Pittonia 1:36. 1887; *Mimulus cusickii* (Greene) Piper, Contr. U. S. Nat. Herb. 11:508. 1906; *Mimulus bigelovii* var. *cuspidatus* Grant, Ann. Mo. Bot. Gard. 11:279–280. 1924.

Grant (1924, pp. 281–282) maintained *Mimulus cusickii* (Greene) Piper and included in it, as a synonym, *M. bigelovii* var. *ovatus* Gray in its entirety. She also presented the new variety *M. bigelovii* var. *cuspidatus.* Study of the type specimens of *M. bigelovii* and *M. bigelovii* var. *cuspidatus* and of the specimens upon which the descriptions of *M. bigelovii* var. *ovatus* and *M. cusickii* were presumably based as well as study of general collections (mostly from Nevada) indicate that Greene's and Grant's entities can be considered conspecific with *M. bigelovii* var. *ovatus* and their proposed names treated as synonyms.